but he is a keen observer, and a piquant writer. He has a charming way of knocking over old conceptions of how things must have been. For instance, the bamboo gridiron becomes a drying-grate; boiling meat in a bamboo pot over the fire is changed to roasting the whole affair, pot and all; holes in the ground to sleep in, are nothing but children playing burial, etc. For comparative technology, the article is invaluable. The necklaces described by Dr. Thomson are made from human bones.

Sir. Bartle Frere's paper, however, is the one of greatest moment. The editor of these notes read a paper on the same topic at the American Association last summer. Sir. Bartle Frere's observations were made in India, where the Aryan peoples have been in contact with uncivilized and more aboriginal races from the earliest times, and in South Africa among the Hottentots, Bushmen, and the Banta Tribes.

## GEOLOGY AND PALÆONTOLOGY.

THE ANCESTRY AND HABITS OF THYLACOLEO.—The recent reception of nearly complete specimens of the mandibles of the *Ptilodus mediævus* (NATURALIST, November, 1881), enables me to correct the table of genera of *Plagiaulacidæ*, given in the May, 1882, NATURALIST. The remarkable mammal in question turns out to have but one huge cutting premolar tooth, and to present considerable resemblance to the supposed "pouched lion" (*Thylacoleo carnifex*) of the Australian Pliocene formation, which excited so much discussion a few years ago in England. Considerable light is thrown on the history of this group, which disappeared so early in Europe and America, to survive in Australia almost up to the present geological age.

The genera of the family differ as follows:

*a.* Several large cutting premolars.

Premolars four, sides not ridged..... *Ctenacodon.*

Premolars typically three, with oblique lateral ridges..... *Plagiaulax.*

*aa.* One large cutting premolar.

$\beta$. Inferior molars with several tubercles.

Large premolar without posterior cusp; edge directed upwards; sides ridged *Ptilodus.*

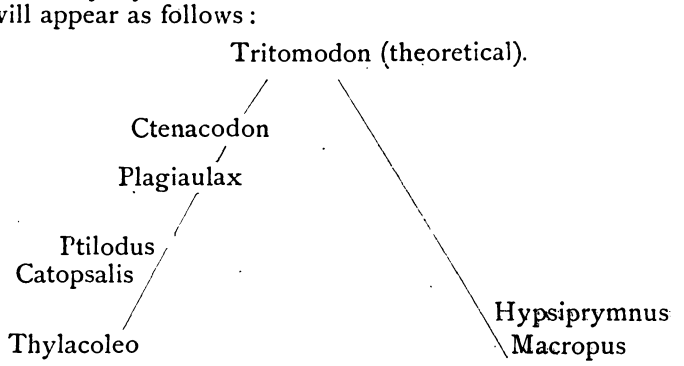
Large premolar with posterior cusp; edge directed forwards; sides (?) not ridged *Catopsalis.*

$\beta_1^2$. Inferior molars small with few lobes; the last rudimental.

Large premolar without posterior cusp; edge directed upwards; sides not ridged *Thylacoleo.*

The phylogeny of these forms, in connection with that of the kangaroos, may be expressed as follows: It is evident that such forms as *Thylacoleo*, *Ptilodus*, and *Catopsalis* are more specialized than *Plagiaulax* and *Ctenacodon*, inasmuch as the number of teeth is reduced, and the cutting function of the premolars is concentrated in a single large tooth. This is quite the same kind of specialization

as that which has taken place in the history of the descent of the Carnivora. *Ctenacodon*, as having the largest number of premolars, which have the least amount of sculpture, is the least specialized of all the genera. *Thylacoleo*, with the rudimental character of the true molar teeth, is the most specialized, as it is the latest in time. The *Macropodidæ* retain the full series of true molar teeth of the primitive Mammalia, and present only a cutting third premolar in the lower jaw, the fourth resembling the true molars. Thus the cutting tooth of *Thylacoleo* is not the homologue of the cutting tooth of *Hypsiprymnus* as supposed by Professor Flower,[1] since the latter corresponds with the cutting tooth of *Ptilodus*, which is the fourth premolar of *Plagiaulax*. We must therefore regard *Hypsiprymnus* as the descendent of a type from which the *Plagiaulacidæ* were also derived, in which some of the premolars, as far as the third only, were trenchant, and in which the fourth premolar possessed the tubercular character of the true molars. Such a type would belong to Jurassic and perhaps even to Triassic times, and might well have continued to the Eocene. I call it provisionally by the name *Tritomodon*. The lines of the descent will appear as follows:




The discussion between Professor Owen, on the one hand, and Messrs. Falconer, Krefft, and Flower, on the other, as to the nature of the food of *Thylacoleo*, is known to palæontologists. From the form of the teeth alone Professor Owen inferred the carnivorous nature of the food of this genus, while his opponents inferred a herbivorous diet from the resemblance between the dentition and that of the herbivorous *Hypsiprymnus*. As the result of the discussion affects, in some degree, the genera *Catopsalis* and *Ptilodus*, I recall it here. The comparison of *Thylacoleo* with *Hypsiprymnus* is weakened by two considerations: First, the fact that the cutting tooth of the former is not homologous with the cutting tooth of the latter; and second, that the grinding series of molars of the former is rudimental, while in the latter it is complete. It evidently does not follow that because *Hypsiprym-*

[1] Quarterly Journal Geological Society, 1868, Vol. XXIV, p. 307.

*nus* is herbivorous, *Thylacoleo* is so also. Professor Flower refers to the reduction of the molars in *Thylacoleo* as slightly complicating the problem, and concludes that the food of that animal may have been fruit or juicy roots, or even meat. It is difficult to imagine what kind of vegetable food could have been appropriated by such a dentition as that of *Ptilodus* and *Thylacoleo*. The sharp thin, serrate, or smooth edges, are adapted for making cuts and dividing food into pieces. That these pieces were swallowed whole, is indicated by the small size and weak structure of the molar teeth, which are not adapted for crushing or grinding. It is not necessary to suppose that the dentition was used on the same kind of food in the large and the small species. In *Ptilodus mediævus* the diet may have consisted of small eggs, which were picked up by the incisors and cut by the fourth premolar. In *Thylacoleo* it might have been larger eggs, as those of the crocodiles, or perhaps carrion, or even the weaker living animals. The objection to the supposition that the food consisted of vegetables, is found in the necessity of swallowing the pieces without mastication. In case it could have been of a vegetable character the peculiar premolar teeth would cut off pieces of fruits and other soft parts as suggested by Professor Flower, but that these genera could have been herbivorous in the manner of the existing kangaroos with their full series of molars in both jaws, is clearly inadmissable.—*E. D. Cope.*

NOTES ON EOCENE MAMMALIA.—The creodont, *Lipodectres penetrans*, turns out to be identical with the *Deltatherium fundaminis*. *Deltatherium absarokæ* must be referred to a new genus with the dental formula I. $\frac{2}{3}$; C. $\frac{1}{1}$; P–M. $\frac{3}{4}$; M. $\frac{3}{3}$. The premolars in *Deltatherium* are $\frac{3}{3}$, and in *Proviverra* $\frac{4}{4}$. The fourth superior premolar has an internal lobe, and a single trenchant external lobe, and the fourth inferior premolar is different from the first true molar. The genus may be called *Didelphodus*.

The *Oligotomus osbornianus* must be referred to a new genus. If it is not condylarthrous, it must be placed in the Chalicotheriidæ, as the most primitive form. The superior true molars have eight cusps, two internal, two intermediate, two principal external, and two external rising from the cingulum. The posterior of the latter is opposite the interval between the principal external, and if confluent with them would complete the two external V's of the other genera of the family. Inferior molars and last premolar, consisting of two V's. I call it *Ectocion*.——*E. D. Cope.*

ON THE TAXEOPODA, A NEW ORDER OF MAMMALIA.—A further examination of the carpus of *Phenacodus* shows that it is different from that of the order *Perissodactyla*, and agrees with that of the *Amblypoda*, *Proboscidea* and *Hyracoidea*. In the three groups last mentioned, the os magnum supports the lunare, and does not

articulate with the scaphoid, while in the *Perissodactyla* it sustains the scaphoid, while the lunar rests extensively on the unciform. As compared with the three groups named, *Phenacodus* stands intermediate between the *Amblypoda* and the *Proboscidea*, and agrees with the *Hyracoidea* in the slight posterior articulation of the unciform with the lunar bone. The peculiar carpus characteristic of the *Perissodactyla* is seen in the genera *Triplopus* and *Hyrachyus*, and in the older *Hyracotherium*, which is the cotemporary of *Phenacodus*. There seems to be no sufficient ground for separating the latter from the *Proboscidea* as a full order, so I combine the two groups in one, under the name of *Taxeopoda*.

The *Taxeopoda* is the primitive type of Ungulata in having the carpal and tarsal bones arranged in linear series. In the more specialized orders of *Perissodactyla* and *Artiodactyla*, the second series of these bones has been rotated inwards one place. The *Amblypoda* has the fore foot of the primitive type, and the hind foot of the more specialized type.

The group of *Ungulata*, whatever rank it may have, will then be divided into the following orders or sub-orders:

I. Os magnum supporting os lunare, and not articulating with os scaphoideum.

*a.* Astragalus articulating only with navicular.

Fibula with interlocking articulation with astragalus..... *Hyracoidea.*
Fibula with lateral contact only with astragalus..... *Taxeopoda.*

*aa.* Astragalus uniting with both navicular and cuboid.

Lunar uniting with unciform; fibula only in contact with astragalus.... *Amblypoda.*

II. Os magnum supporting os scaphoideum; lunar supported in part by unciform. Astragalus uniting with both cuboid and navicular.

Astragalus truncate distally; median digit longest..... *Perissodactyla.*
Astragalus ginglymoid distally; two median digits equal..... *Artiodactyla.*

The *Taxeopoda* are naturally divided into two sub-orders, the Proboscidea and Condylarthra, as follows.

No postglenoid process, nor third trochanter of femur. Fibula articulating with a facet of the calcaneum..... *Proboscidea.*
A postglenoid process, and a third trochanter of the femur; no calcaneal facet for fibula..... *Condylarthra.*

It is probable that the *Toxodontia* form a third division of the *Taxeopoda*. It is also probable that the *Hyracoïdea* should be reduced to the position of a subdivision of the *Taxeopoda*—*E. D. Cope.*

GEOLOGICAL NEWS.—In the *Geological Magazine* for March, Mr. A. S. Lucas discusses the age of the Headen Beds of the Isle of Wight, and M. J. E. Lee notes a peculiarity in the structure of a Pteraspidean plate found in the Eifel. This plate shows a repetition of the usually supposed outer corrugated layer, one of which is placed between two honey-comb layers, and an absence of the nacreous layer, thus throwing some doubt upon the received order of the occurrence of these layers. Mr. E. T. Newton gives a list of seventeen species of fishes, the remains of which have been

found in the Forest-bed series of the east of England.——At a recent meeting of the Geological Society of London, Professor Owen described *Notochelys costata*, an extinct Chelonian from Blinder's river, Queensland. It is the first known Australian fossil turtle, and is of a generalized type between the Chelydrians and marine turtles. At the next meeting of the same society (Feb. 8, 1882), Mr. J. W. Hulke described *Iguanodon Seelyi* from a bed between the clays and gravel of the cliff in Brook bay, Isle of Wight.——Various and prolific seams of anthracite and bituminous coal, some of them 10 ft. or 12 ft. in thickness, have been found in Natal.——Professor Marsh contributes to the *American Journal of Science*, an article upon the wings of Pterodactyles, with a full size plate of *Rhamphorhynchus phyllurus* Marsh. The specimen described was found in the lithographic states of Bavaria, and shows very perfect impressions of the volant membranes of both wings, as well as of a separate. vertical rudder at the end of the long tail. The membrane was similar to that of bats.——In the Journal of the Cincinnati Society of Nat. History, Mr. S. A. Miller describes some new species and genera of Palæozoic fossils. He also gives a well-merited criticism of Professor Nicholson's book on *Monticulipora*, showing the extensive ignorance of its author of American writings on the subject. We performed the same duty for the same writer's manual of Palæontology a year or two ago.

## MINERALOGY.[1]

TWO NEW GUANO MINERALS.—Professor C. U. Shepard[2] has described two new minerals which have originated in the guano formation covering the islands of Moneta and Mona, near Porto Rico, W. I., and to which he gives the names *Monetite* and *Monite*. They were found lining the walls of cavities in the rock guano, and, though undoubtedly formed through the action of percolating waters, contain no organic matter.

*Monetite* occurs in crystals having the form of rather thin rhomboids, often interpenetrating each other to form complex groups. Mr. E. S. Dana refers them to the triclinic system. Their greatest length is between $\frac{1}{12}$th and $\frac{1}{20}$th of an inch.

The mineral has an uneven fracture, a vitreous lustre, a pale, yellowish-white color, and is semi-transparent; hardness 3.5; specific gravity about 2.75. Heated before the blow-pipe in the forceps, it turns white and melts into a globule with crystalline facets.

It has the following composition (mean of two analyses by C. U. Shepard, Jr.):

| Lime | Phosphoric acid | Sulphuric acid | Water. |
|---|---|---|---|
| 40.255 | 47.100 | 4.550 | 8.175 = 100.080 |

[1] Edited by Professor HENRY CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

[2] American Journal Sciences and Arts, May, 1882, p. 400.